Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of:	)	
	)	
Office of Engineering and Technology	)	ET Docket No. 17-340
Announces Technological Advisory Council	)	
(TAC) Spectrum Policy Recommendations	)	

COMMENTS OF
THE NATIONAL PUBLIC SAFETY TELECOMMUNICATIONS COUNCIL

The National Public Safety Telecommunications Council (NPSTC) submits these comments in response to the Public Notice in the above captioned proceeding.[1] The Public Notice seeks comment on spectrum policy recommendations by the TAC that would create significant changes in interference protection for authorized spectrum users.

In general, NPSTC believes TAC recommendations on additional consideration of receiver characteristics and on increased use of quantitative analysis in spectrum sharing both have merit. NPSTC believes that setting interference thresholds will be especially complex and challenging, especially for communications systems that support safety-of-life, where any interference could have potentially drastic consequences. NPSTC also believes that actual implementation of the TAC recommendations would require the Commission to increases its engineering staff.

[1] Public Notice, *Office of Engineering and Technology Seeks Comment on Technological Advisory Council Spectrum Policy Recommendations*, ET Docket No. 17-340, released December 1, 2017.

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The National Public Safety Telecommunications Council

The National Public Safety Telecommunications Council is a federation of public safety organizations whose mission is to improve public safety communications and interoperability through collaborative leadership. NPSTC pursues the role of resource and advocate for public safety organizations in the United States on matters relating to public safety telecommunications. NPSTC has promoted implementation of the Public Safety Wireless Advisory Committee (PSWAC) and the 700 MHz Public Safety National Coordination Committee (NCC) recommendations. NPSTC explores technologies and public policy involving public safety telecommunications, analyzes the ramifications of particular issues and submits comments to governmental bodies with the objective of furthering public safety telecommunications worldwide. NPSTC serves as a standing forum for the exchange of ideas and information for effective public safety telecommunications.

The following 16 organizations serve on NPSTC's Governing Board:[2]

American Association of State Highway and Transportation Officials
American Radio Relay League
Association of Fish and Wildlife Agencies
Association of Public-Safety Communications Officials-International
Forestry Conservation Communications Association
International Association of Chiefs of Police
International Association of Emergency Managers
International Association of Fire Chiefs
International Municipal Signal Association
National Association of State Chief Information Officers
National Association of State Emergency Medical Services Officials
National Association of State Foresters
National Association of State Technology Directors
National Council of Statewide Interoperability Coordinators
National Emergency Number Association
National Sheriffs' Association

[2] These comments represent the views of the NPSTC Governing Board member organizations.

Several federal agencies are liaison members of NPSTC. These include the Department of Homeland Security (the Federal Emergency Management Agency, the Office of Emergency Communications, the Office for Interoperability and Compatibility, and the SAFECOM Program); Department of Commerce (National Telecommunications and Information Administration); Department of the Interior; and the Department of Justice (National Institute of Justice, Communications Technology Program). Also, Public Safety Europe is a liaison member. NPSTC has relationships with associate members: The Canadian Interoperability Technology Interest Group (CITIG) and the Utilities Technology Council (UTC), and affiliate members: The Alliance for Telecommunications Industry Solutions (ATIS), Open Mobile Alliance (OMA), Telecommunications Industry Association (TIA), TETRA Critical Communications Association (TCCA), and Project 25 Technology Interest Group (PTIG).

NPSTC Comments

The Commission's Office of Engineering and Technology (OET) has provided spectrum policy recommendations developed by the Technological Advisory Council (TAC), and has asked for comment on those recommendations. The TAC has recommended the Commission consider adopting the following nine spectrum management principles:[3]

Principle #1 -- Harmful interference is affected by the characteristics of both a transmitting service and a nearby receiving service in frequency, space or time;

Principle #2 – All [radio] services should plan for non-harmful interference from signals that are nearby in frequency, space or time, both now and for any changes that occur in the future;

Principle #3 – Even under ideal conditions, the electromagnetic environment is unpredictable. Operators should expect and plan for occasional service degradation or interruption. The Commission should not base its rules on exceptional events;

[3] Public Notice at pages 2 and 3.

Principle #4 – Receivers are responsible for mitigating interference outside their assigned channels;

Principle #5 – Systems are expected to use techniques at all layers of the stack to mitigate degradation from interference;

Principle #6 – Transmitters are responsible for minimizing the amount of their transmitted energy that appears outside their assigned frequencies and licensed areas;

Principle #7 – Services under FCC jurisdiction are expected to disclose the relevant standards, guidelines and operating characteristics of their systems to the Commission if they expect protection from harmful interference;

Principle #8 – The Commission may apply Interference Limits to quantify rights of protection from harmful interference; and

Principle #9 – A quantitative analysis of interactions between services shall be required before the Commission can make decisions regarding levels of protection.

In addressing these principles, the Public Notice addresses the TACs belief that quantitative risk assessments can be applied successfully in an industry where safety-of-life is paramount, based on some experience in the Nuclear Regulatory Commission (NRC). Based on the NRC experience, the TAC also advises the Commission to start soon and start "small" without attempting a major overhaul of its regulatory approach as changing an industry's culture takes time.[4]

The Public Notice also seeks comment on whether and how these principles may be integrated into Commission spectrum policy. NPSTC offers some preliminary input below. It appears that incorporation of one or more of the TAC recommendations into Commission spectrum policy would require follow-on rulemakings that would offer more specific proposals for comment regarding the various radio services impacted. Therefore, NPSTC believes any potential actual implementation of the TAC recommendations into Commission spectrum policies is more in the nature of a marathon than a sprint.

[4] Public Notice at page 5.

From a licensee/user perspective, NPSTC believes implementation of the TAC recommendations could have the following primary implications:

- Greater involvement of and reliance on receiver immunity and standards
- Potential pressure on incumbent licensees to accept and tolerate interference
- Greater reliance on quantitative analysis

NPSTC addresses these implications in the remainder of these comments.

A. Greater Involvement of and Reliance on Receiver Immunity and Standards

In general, the Commission currently does not regulate receiver immunity. NPSTC believes that consideration of receiver characteristics as part of the overall equation of spectrum management that the TAC has recommended is a positive step. Any potential improvements of course would need to be technically feasible for manufacturers and available at reasonable cost for public safety entities. Also, any new standards or requirements would need to be phased in over time, as public safety entities maintain current equipment in service until its useful life is completed. Factoring in any new and improved receiver filtering would need to be phased in, as the imbedded base of equipment could still be in place over a number of years. A typical lifespan for a public safety handheld (portable) radio is seven years or more. Public safety mobile radio equipment may be in service for 15-25 years.[5] To the extent infrastructure equipment is part of the equation, a lifespan of 15 years or more is relatively normal. These are factors the Commission need to take into account if/when it were to adopt any receiver requirements.

[5] An example would be a radio mounted in a piece of firefighting apparatus, which would remain in service with the vehicle for the entire front-line and reserve service life of the vehicle.

Measurement procedures also would need to be implemented within industry to ensure any new or improved receiver parameters are properly measured and reported to prospective purchasers. For example, current land mobile receivers exhibit different intermodulation rejection (IMR) characteristics when in the presence of strong undesired signals than when in the presence of weaker undesired signals.[6] The current standard measurement procedure was developed for weaker signal level environments normally found in land mobile radio implementations. Also, that standard was developed when signal levels were expected to be more equal in level, have narrow bandwidth and use the same technology. The current situation in which public safety and other land mobile systems are forced to operate in an environment of increasingly very strong broadband cellular signals at ground level in adjacent spectrum, compared to weaker LMR signals, was not envisioned when the measurement procedure was developed.

While it will take some time to do so, NPSTC recommends that the Telecommunications Industry Association (TIA) consider updating its current land mobile radio measurement and performance standards to include a Strong Signal Intermodulation Measurement (SSIM) methodology, as discussed at the Commissions November 6, 2017 multi-stakeholder Forum. SSIM is a key consideration when assessing radio performance in an environment becoming increasingly prone to higher cellular power levels and interference.

NPSTC believes a documented measurement procedure should be beneficial to manufacturers in making and confirming any possible improvements in IM rejection for a strong signal environment. In turn, it would also help public safety agencies as part of their consideration when purchasing equipment.

[6] See IM rejection measurements addressed by Jay Jacobsmeyer at the Commission Public Forum on Improving Sharing in the 800 MHz Band held November 6, 2017.

In considering ways to help minimize the risk of interference in an increasingly crowded spectrum environment, NPSTC believes it is important to recognize there are multiple interference mechanisms. In adopting procedures to help minimize interference, the Commission must to be able to discern which interference mechanisms can benefit from receiver improvements and which must be addressed at the offending transmitter facilities. Also, while promoting broadband is of great policy interest at the Commission, the reality is that the spectrum environment includes multiple technologies as one size does not fit all when considering a variety of users' communications requirements. Furthermore, all interference is not necessarily from a single carrier. When considering interference potential between commercial carrier and public safety services, NPSTC recommends the Commission account for situations in which multiple carriers can have an additive affect, creating a higher-level interfering signal.

NPSTC consulted with a trusted and experienced spectrum engineer and offers the following information on multiple types of interference, considering both broadband and land mobile deployments.

Receiver Desensitization - Usually Resolved at the Receiver

1) Overload - ability of receiver to reject strong adjacent band signals, usually in excess of -25 dBm. Overload is related to receiver bandwidth and IM rejection. Strong signals may overload a receiver or generate IM products within the receiver. The risk of interference is reduced with a narrower receiver bandwidth and/or better IM rejection and/or attenuation of all signals into the receiver in strong desired signal areas using radiofrequency automatic gain control (RF AGC). Current -15 to -20 dBm broadband signals in adjacent bands have been pushing limit of current land mobile radio (LMR) receiver designs. Broadband signals in excess of -15 dBm may be difficult to reject even with the best receiver LMR filtering and IM rejection, requiring LMR licensees to design systems to higher desired signal levels. This also would transition overall system designs from the current noise-limited approach to an interference-limited approach that requires more transmitter sites, a significant budgeting issue for public safety.

2) Intermodulation Rejection (IMR) is the ability of a receiver to reject strong signals, usually greater than -40 dBm, that mix inside the receiver generating IM products falling on the desired receive frequency. IM products may be created by in-band signals or very strong out-of-band signals. 85 dB IMR (about -35 dBm undesired signal level) is about state-of-the-art in current LMR receivers and LMR noise limited system design.

3) Adjacent Channel Rejection or Receiver Selectivity – The ability of the receiver intermediate frequency circuitry (IF) to reject in-band signals, usually on adjacent channels.

4) Spurious Response – The ability of a receiver to reject strong signal frequencies, usually greater than -50 dBm, that fall on/near the IF or oscillator frequencies within the receiver.

Transmitter Created Interference into Receiver - Must be Resolved at Transmitter thru Better Transmitter Design and/or Additional Filtering

1) Transmitter Sideband Noise, usually from adjacent/alternate channels

2) Transmitter Out-of-Band Emissions, >250% of channel bandwidth

3) Spurious Emissions & Harmonics - Discrete frequencies falling on receive frequency

4) External intermodulation - usually created by transmit frequencies mixing at site, external to receiver. Must be resolved at site with additional filtering or isolation.

This information should be helpful to the Commission in assessing which types of interference would potentially benefit from any possible receiver improvements by the party experiencing the interference, and which situations instead must be addressed at the transmitter facilities of the party causing the interference.

B. Potential Pressure on Incumbent Licensees to Accept and Tolerate Interference

TAC Recommendations #2 and # 3 state that all services should plan for non-harmful interference and that operators should expect and plan for occasional service degradation or

interruption. Also, TAC recommendation #8 envisions the Commission determining and applying a level for harmful interference, as part of establishing the rights of licensees. NPSTC believes this may be the most complex and controversial aspect of the TAC recommendations. The level of "non-harmful interference" and that of "harmful interference" is likely to be different for different services and uses of the spectrum. For example, a safety-of-life application of radio systems would have a much lower tolerance for interference than a use solely for entertainment.

It is hard to imagine a public safety radio technician saying to a Chief of Police, Sheriff, or Fire Chief, "you should plan on some disruptions to communications while your officers, deputies and firefighters are approaching a car/driver with unknown firepower, working a hostage situation, responding to a terrorist attack or fighting a fire." Any disruption of communications could result in devastating circumstances for public safety entities and the public they serve.

Unfortunately, in public safety, even a seemingly innocuous "everyday" situation can very quickly turn into a crisis for public safety personnel on the street. Therefore, trying to define interference levels that would apply only to safety-of life situations, with a different threshold for daily operations may be very challenging. One only has to pay attention to the news to know that public safety personnel on the street increasingly face "routine situations" that quickly move to include the risk of being killed, and sadly, that result does at times materialize. Therefore, in an instant, non-harmful interference could change to harmful interference.

C. Greater Reliance on Quantitative Analysis

NPSTC believes the TAC recommendations regarding greater use of quantitative analysis have some merit. It could be especially beneficial when a set of analysis on some potential spectrum

sharing starts with the premise that existing services need to be protected, and analyzes whether or not that would occur. The analysis would need to include an accurate snapshot of the existing services and uses in a given segment of spectrum on which the sharing premise is being tested. Then, parameters of the proposed service that match actual intentions and likely penetration of the proposed new service if it were authorized would need to be included in the analysis. For example, on occasion, NPSTC has seen analysis that uses one power level while a higher power level was requested for the rules or does testing and analysis in less populated areas with a lower likelihood for interference while any resulting service would be operated in all areas. Obviously, those types of testing or analysis would not provide an accurate picture of the interference potential. Also, as interference levels can be additive from multiple transmitters, as accurate a prediction as possible on penetration levels of devices and/or sites associated with a proposed new service should be included as part of the analysis.

NPSTC does not purport that this is an exhaustive list of requirements for credible analysis. It merely signifies that analysis must be properly designed and conducted to provide any credible results. Therefore, if it moves forward with any rulemakings and ultimately incorporates the TAC recommendations into actual policies or rules, NPSTC believes the Commission will require additional engineering talent. Although dated, NPSTC found an article that indicated only 31% of the Commission's professional staff were engineers in 2010.[7] While we were unable to locate information on the current percentage or number of engineers, implementing the TAC recommendations on greater use of quantitative analysis certainly would appear to add significant workload that likely would require additional engineers at the Commission.

[7] *Staff at the FCC: How Many Lawyers, Economists and Engineers*, http://stevencrowley.com/2010/09/19/staff-at-the-fcc-how-many-lawyers-economists-and-engineers/

Conclusion

NPSTC appreciates the opportunity to provide input on the TAC spectrum policy recommendations. If implemented through further rulemaking proceedings, the TAC recommendations would include an additional focus on receiver immunity and standards, place potential pressure on incumbent licensees to accept and tolerate interference and incorporate greater reliance on quantitative analysis. In general, NPSTC supports additional involvement of receiver immunity and standards with receiver improvements that are technically feasible and can be provided at reasonable costs. The Commission would need to phase in consideration of such improvements over time, as public safety entities maintain current equipment in service until its useful life is completed.

In these comments NPSTC also addresses a specific recommendation for TIA to consider updating its current land mobile radio measurement and performance standards to include a Strong Signal Intermodulation Measurement (SSIM), necessitated by an environment becoming increasingly prone to higher cellular power levels at ground level and associated potential interference.

NPSTC believes that any implementation of interference thresholds to define either "harmful interference" or "tolerable non-harmful interference" would be complex and require different thresholds for different services. Any disruption of communications from interference could result in devastating circumstances for public safety entities and the public they serve.

Finally, NPSTC believes increased use of credible quantitative analysis on spectrum sharing has merit. Reliance on such quantitative analysis would result in a significant increase in workload and likely would require the Commission to employ additional engineers in its workforce.

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January 31, 2018